SUPPLEMENT TO

Report of the Work of The Rubber Research Board in 1940.

(*Established under the Rubber Research Ordinance Chapter* 302).

REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1940.

December, 1941.

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The Committee and Technical Sub-Committee held two meetings during the year. There were also two meetings of the Sub-Committee on Standardisation of Raw Rubber appointed in 1937.

The Committee regret to report the deaths of Sir Herbert Wright and Mr. B. D. Porritt, also the following resignations: Dr. W. Youngman, Professor Clements and Mr. W. C. Smith. In view of Sir Frank Stockdale's appointment as Controller for Development and Welfare in the West Indies, he has been succeeded by Dr. H. A. Tempany as representative of the Colonial Advisory Council of Agriculture and Animal Health. Dr. J. R. Scott and Dr. S. Pickles are serving as members of the Technical Sub-Committee vice Mr. B. D. Porritt and Mr. W. C. Smith respectively.

Meetings of the Committee and Sub-Committees were attended by Mr. T. E. H. O'Brien, Director, Rubber Research Scheme, Ceylon and the following members of the scientific staff of the Rubber Research Institute, Malaya, while on leave in this country: Messrs. C. E. T. Mann, J. H. Piddlesden and E. R. Guest.

CO-OPERATION WITH OTHER ORGANISATIONS

Close co-operation was maintained throughout the year with the Research Association of British Rubber Manufacturers, whose help in connection with the work of the Standardisation Sub-Committee and in obtaining opinions of manufacturers concerning special samples of rubber and latex, was of particular value.

The Committee's staff attended the monthly technical discussions at the laboratories of the British Rubber Producers Research Association and at one of these meetings gave an account of the work in progress at the Imperial Institute.

FINANCE

Contributions of £2,625 and £875 were received from the Rubber Research Institute and the Rubber Research Scheme, respectively, during 1940. Expenditure amounted to £3,916.14.6., leaving an unexpended balance of £1,182.13.10. at 31st December, 1940; the small increase in expenditure, as compared with last year, being chiefly due to the purchase of new equipment.

ACTION ARISING OUT OF THE WAR

The staff undertook a successful investigation of a problem connected with Home Defence, the results of which may have peace time applications. A considerable amount of time was expended on this work, but the details naturally cannot be disclosed.

STANDARDISATION OF RUBBER

The investigations on this subject again formed an important part of the work during the year. The Committee considered that as it would be difficult to introduce new market grades of clean and uniform rubber during the war, no action should be taken with a view to applying the conclusions obtained until more suitable conditions arise.

INVESTIGATIONS

As a result of the investigations on latex a comprehensive picture of its structure is being systematically developed — attention being given not only to the nature of the substances present, but also to their situation and arrangement with respect to their physical relationships. The functions of different groups of substances and the factors determining quality are in consequence becoming more clearly defined. The information so far obtained is incomplete and the investigations are being continued, but the prospects of developing rational and practical tests for quality are definitely improved.

Preliminary work on the fractionation of rubber, ultimately connected with the possibility of obtaining different rubber hydrocarbons by selective propagation, has been in progress for some time and is leading to conclusions somewhat different from those obtained by other investigators. The results suggest that rubber contains a mixture of hydrocarbons which differ not so much in solubility as in rate of solution and that non-rubber substances can have marked effects on the rate of solution without necessarily affecting the size or chemical identity of the rubber hydrocarbon. Normal methods of testing may therefore yield misleading results concerning difference between hydrocarbon fractions and the possibility of devising a reliable test is under consideration.

In connection with the preparation on a large scale of clean and uniform rubber, attention has been given to the inconstancy of the same method of test carried out in different laboratories. It has not been found possible to eliminate all the discrepancies, but the problem is still under investigation, and there are several ways in which the difficulties may be overcome.

Manufacturers have displayed considerable interest in clean rubber and also in softened rubber prepared by a method devised by the staff of the Rubber Research Institute, Malaya and large scale trials have been arranged.

REPORTS ON INVESTIGATIONS FORWARDED TO CEYLON AND MALAYA DURING 1940

LATEX

(1) Quality.

(a) Effect of Potassium oleate,

(b) Effect of Potassium palmitate,

(c) Properties of dried films from latex purified with soap.

(2) Applications of the Langmuir Trough.

(3) Examination of five samples from Ceylon.

(4) Effect of storage.

(5) Solubility of rubber from preserved latex.

(6) Antioxygens in latex.

(7) Determination of ammonia (NH_3).

(8) Gelling test.

(9) Fatty acids.
(a) Method of determination,
(b) Distribution between rubber and serum.

DRY RUBBER

(1) The resistance to abrasion of special types of rubber.

(2) Low water absorption rubber.

(3) Effect of conditions of storage and accessory substances on the properties of rubber.

(4) Co-operative tests with the Research Association of British Rubber Manufacturers.

(5) Comparison of two Schopper machines.

(6) Softened rubber from Malaya.

(7) Standardisation of testing.

PATENTS

As in previous years, the Rubber Research Institute, Malaya and the Rubber Research Scheme, Ceylon were supplied with copies of specifications in respect of inventions relating to processes for the preparation or utilisation of raw rubber and latex likely to be of interest to them, and applications were made for English Patents arising out of the work of the staffs in London and the East.

Complete specification accepted during 1940.

529246 Compounding latex.

Complete specifications filed during 1940.

22153/39 Peptising Agents (communicated by the R. R. I. Malaya).

31244/39 Captax as Peptising Agent (communicated by the R. R I. Malaya).

31245/39 Benzoyl Peroxide as Peptising Agent (communicated by the R. R. I., Malaya).

Other Patents in Force at 31st December, 1940.

428100 Rubber and Road Tar Mixtures.

450222 Hemi-Cellulose Creaming Agent.

415133 Organic Colloidal Addition to Latex.

474651 Concentration of Latex by Creaming.

484712 Rubber and Cement Mixtures.

Patents Abandoned during the year.

465226
476743
476269
476073

(Sgd.) P. J. BURGESS
Chairman

(Sgd.) E. CROWHURST
for Secretary

Imperial Institute

July, 1941

TECHNICAL APPENDIX TO REPORT OF THE LONDON ADVISORY COMMITTEE, 1940

I. LATEX

Object.—The investigations on latex have been concerned chiefly with the elucidation of factors responsible for the technical behaviour of latex so as to devise tests which would be helpful in controlling and improving quality. The problem is complex because of the wide range of non-rubber substances in latex most of which are likely to be of some importance and have different effects according to whether they occur in the rubber particles or in the water or are concentrated at the surface between rubber and water.

Method.—The first step consisted in studying the distribution between rubber and water of certain important groups of substances such as proteins acids and esters. The conclusions regarding proteins were given in the last report, and during this year fatty acids, esters and water-soluble acids have received the most attention. The estimation of these substances by the usual methods proved unreliable necessitating preliminary investigations on the method of determination.

Conclusions.—Improved methods were applied to a study of latex from Ceylon and it was shown that the rubber particles contain not only 0.02 to 0.03 per cent nitrogen but also esters of long and short chain acids. On keeping the latex for some time these esters are apparently gradually decomposed forming water-soluble ammonium salts and soaps, which then pass out of the rubber, the former into the aqueous serum and the latter mostly into the boundary between rubber and water. Only a small proportion of the protein in latex is at the surface, but this layer is an important factor controlling the properties of preserved latex. It can be easily replaced by soap with corresponding changes in the properties of latex.

Technical Applications.—This picture of the structure of preserved latex is incomplete as the distribution of some groups of substances has not yet been studied, but it is considered to be of considerable technical importance as it is now possible to assess the function of protein, fatty acid and water-soluble acid in the behaviour of latex. The possibility of controlling and perhaps improving quality is enhanced because the factors involved are more

clearly defined. The substances at the surface of the rubber particles are of obvious importance in determining stability and coagulation phenomena, but it is known from many experiments that the water-soluble serum substances, most of which are apparently unassociated with the surface of the particles, also play an important part. Their function was at first not clearly understood, particularly when it was demonstrated that surface concentration was not markedly dependent upon concentration in the aqueous phase, but it has now been shown that their action is due to reaction with coagulants and some compounding ingredients thereby modifying considerably the technical behaviour of latex. This is illustrated by a study which has been made of sodium silicofluoride as a coagulant, with the object of devising a suitable gelling test for latex. It was found that the test measured not only the resistance of a given latex to coagulation by electrolytes but also the rate of formation of coagulating ions, a reaction which was found to be retarded considerably by some of the serum constituents. One of the most important compounding ingredients in latex is zinc oxide which, from the Committee's zinc oxide stirring test, is known to give results parallel to the concentration of water-soluble serum substances. The reaction between zinc oxide and serum cannot be the same as those between sodium silicofluoride and serum, although there may be some points in common such as the mechanical effect of surface-active materials in hindering chemical reactions. The relations between zinc oxide and serum are therefore being studied in detail, and preliminary tests suggest that the water-soluble acids, which it has been shown are wholly in the aqueous phase, are of considerable importance. The extraction of these acids by chemical methods is rather slow and attention is being given to the electro-metric titration of latex which may enable quick comparisons to be made between the aqueous phases of different latices. The technical importance of the surface-active substances at the boundary between rubber particles and water also needs attention, but the investigation is being deferred until sufficient information has been obtained to enable the aqueous or serum phase to be brought under control.

II. DRY RUBBER

Fractionation of Caoutchouc.—That rubber contains soluble and insoluble fractions has been known for a long time (Gladstone and Hibbert J.C.S. 1888 p. 680). This fact may prove to be of considerable importance to the plantation industry, since it may be possible to produce on a large scale special types of rubber by selective propagation. Until recently little interest was shown in the subject, but during the past year papers have been published emphasising its importance to the rubber plantation industry. Apart from the possibility of preparing naturally soft rubber, however, the advantages are not as promising as these suggestions imply because nearly all dry rubber is machined

(masticated) by manufacturers, both tough and soft rubber being reduced to the same level of plasticity. On the other hand, it is possible that some important differences in rubber hydrocarbons may not be eliminated by mastication and experiments on the fractionation of rubber have been in progress for some time in the Committee's laboratories in so far as staff has been available for the purpose.

Separation of rubber into soluble and insoluble fractions is found to be markedly dependent upon the presence of small quantities of other substances some of which have a purely physical effect which disappears when the substance is removed. In addition the solution of the rubber appears to be a continuous process, the rate following a well-defined law, so that there is no separation into soluble and insoluble fractions but an arbitrary separation of quickly and slowly dissolving rubber. Each fraction probably represents an average and not a clear-cut separation of different hydrocarbons. The rate of solution is slightly retarded by the mechanical arrangement of non-rubber substances and is markedly affected by the period during which the rubber is exposed to a dry atmosphere before immersing in the solvent. The rate of solution of unpurified rubber containing a normal amount of anti-oxygen is unaffected by stirring in the presence of light and air as long as the period of immersion in the solvent does not exceed a few days.

With these conclusions in mind, it is not difficult to devise a simple test for measuring rate of solution, but it is necessary to distinguish between reversible effects due to non-rubber substances and irreversible effects which may represent important differences in the hydrocarbon. It is possible, therefore, that tests comparing different samples of rubber require that solution should be attempted in solvents containing strong polar substances to ensure the elimination of uncontrolled reversible effects due to non-rubber substances. De Vries adopted a similar procedure when comparing the viscosities of solution of different samples of raw rubber.

Variability.—Variability has been the subject of years of research by investigators which, although of incalculable value in defining the factors which affect vulcanising properties, has not definitely been aimed at marketing a special grade of uniform rubber. For this purpose it is necessary to have agreed tests, numerical standards and practical methods of preparation without over-elaborate arrangements for classifying and controlling the product. Detailed schemes of investigations on these lines are in progress both in the East and in London.

Those in London (in the Committee's laboratories) have been concerned chiefly with methods of test, and have shown that testing machines are very reliable as long as they are mechanically sound, but the tensile

strength results are markedly dependent upon the sharpness of the knives employed to cut out ring test pieces. Differences in tensile strength of 30 per cent were found in rings cut from the same slabs by four different laboratories and tested on the same machine. The problem is still under investigation, however, and attention is being given to a bursting test which eliminates errors due to flaws associated with the cutting of the test pieces.

New Types of Rubber and Latex.—Samples of rubber and latex with special properties have been submitted to manufacturers on behalf of the research organisations in the East. Of these softened rubber prepared by treating latex with mercaptobenzthiazole is attracting the most attention.

(Sgd.) G. MARTIN,
Superintendent of Rubber Investigations.

(Sgd.) P. J. BURGESS
Chairman

Imperial Institute,
July, 1941